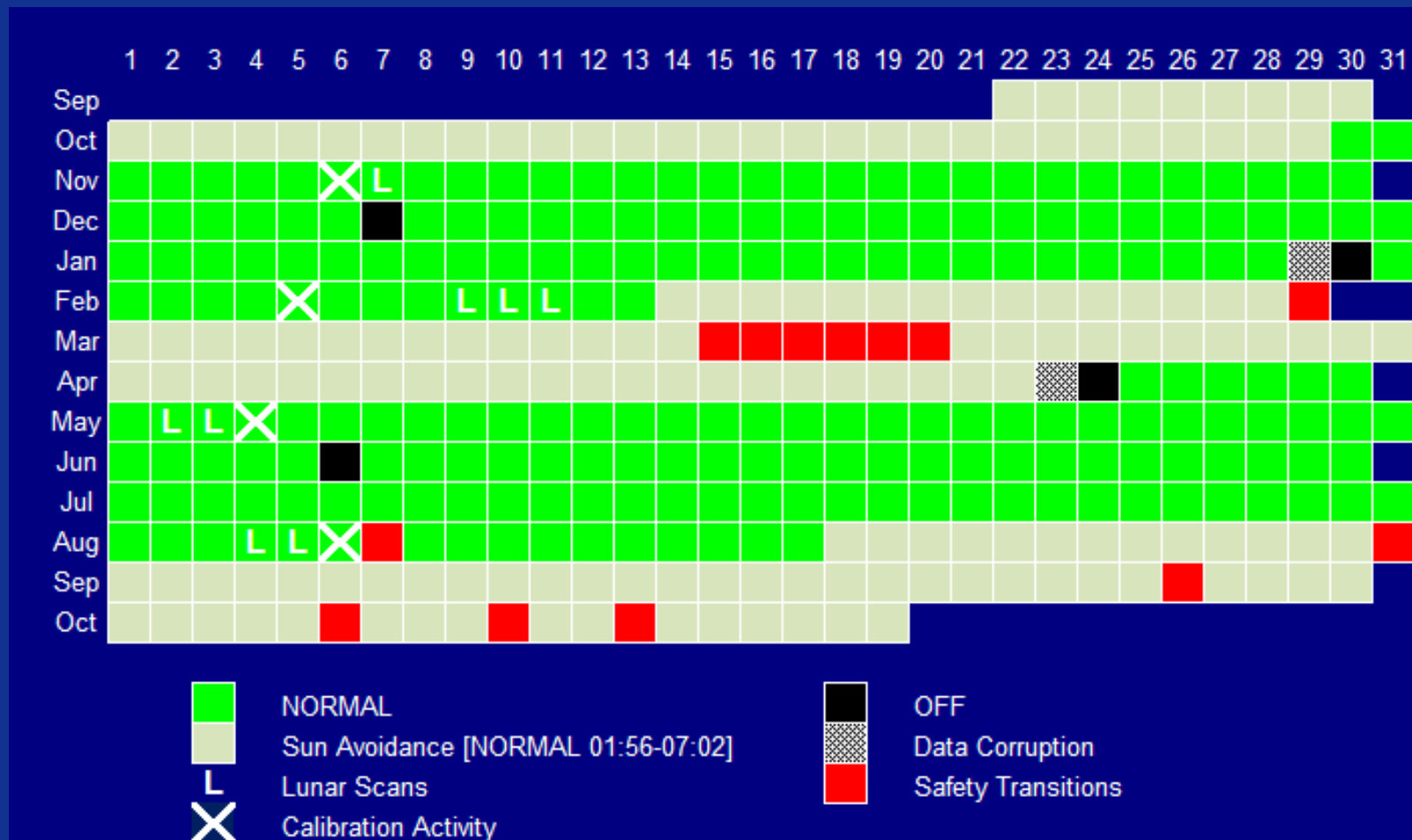
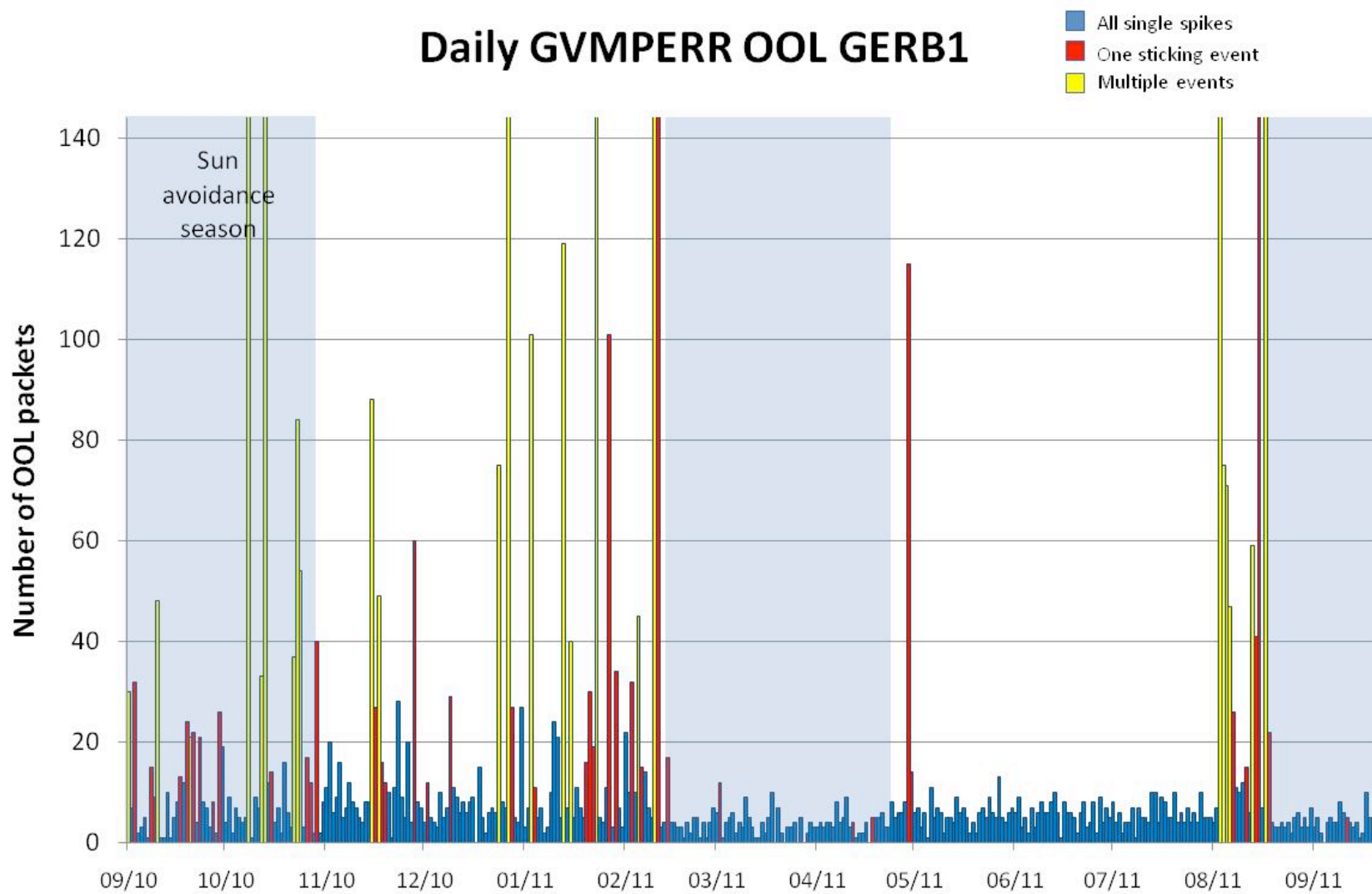


# GERB Operations: Status Report & GERB3 Commissioning James Rufus

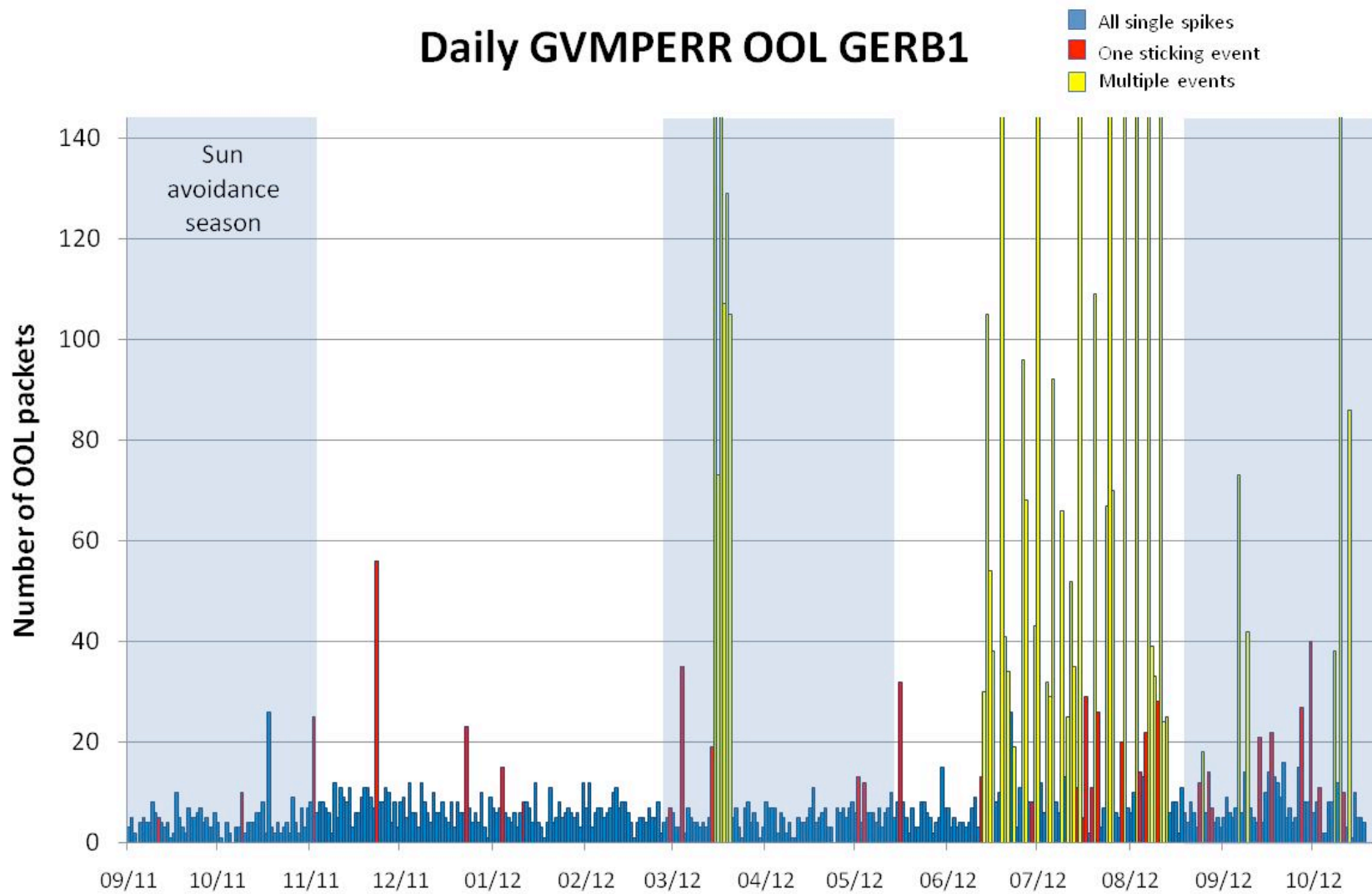
GIST 32  
GFDL, Princeton  
22<sup>nd</sup> – 25<sup>th</sup> October 2012

# GERB1 Operations Summary

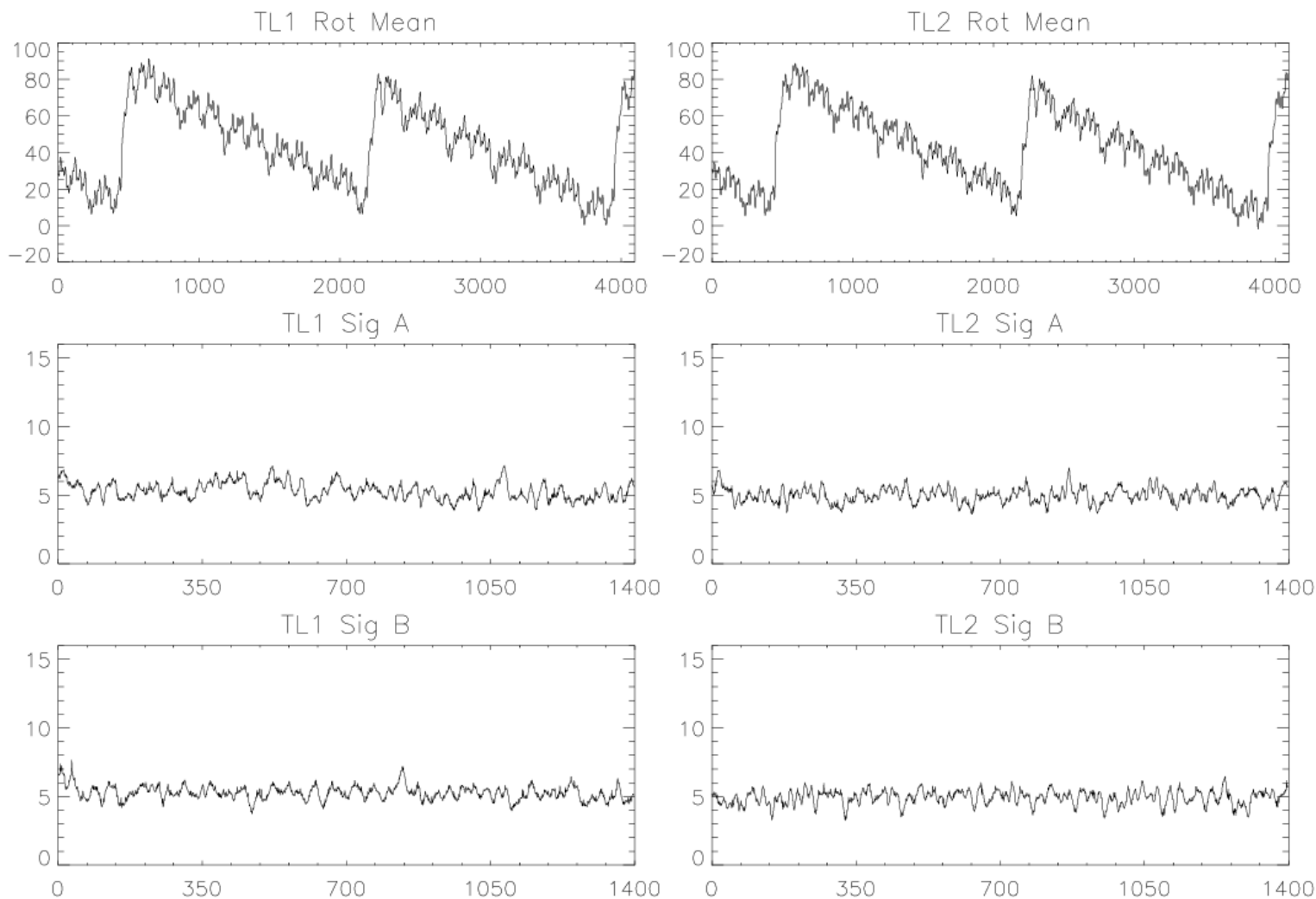




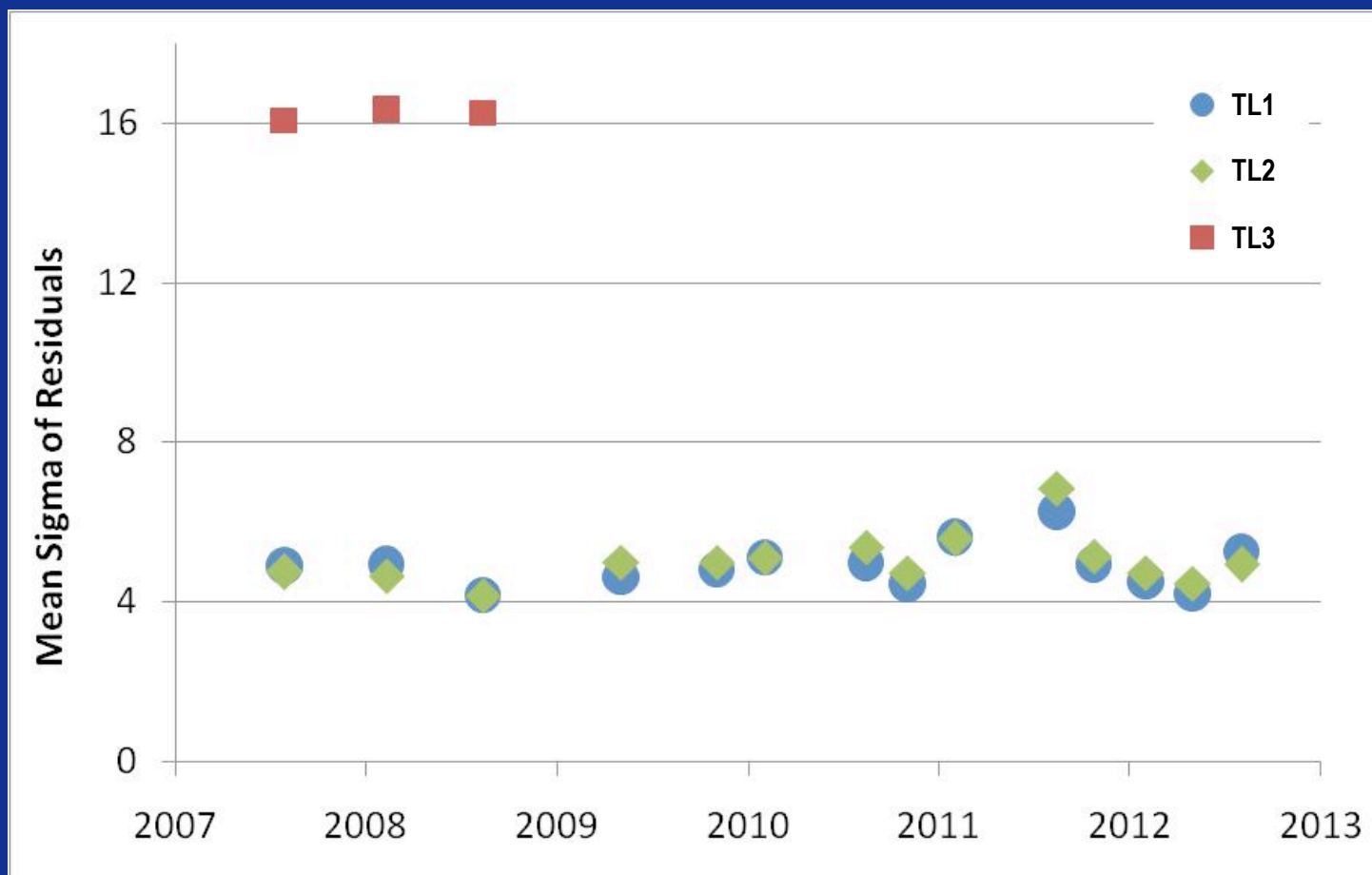
## Daily GVMERR OOL GERB1



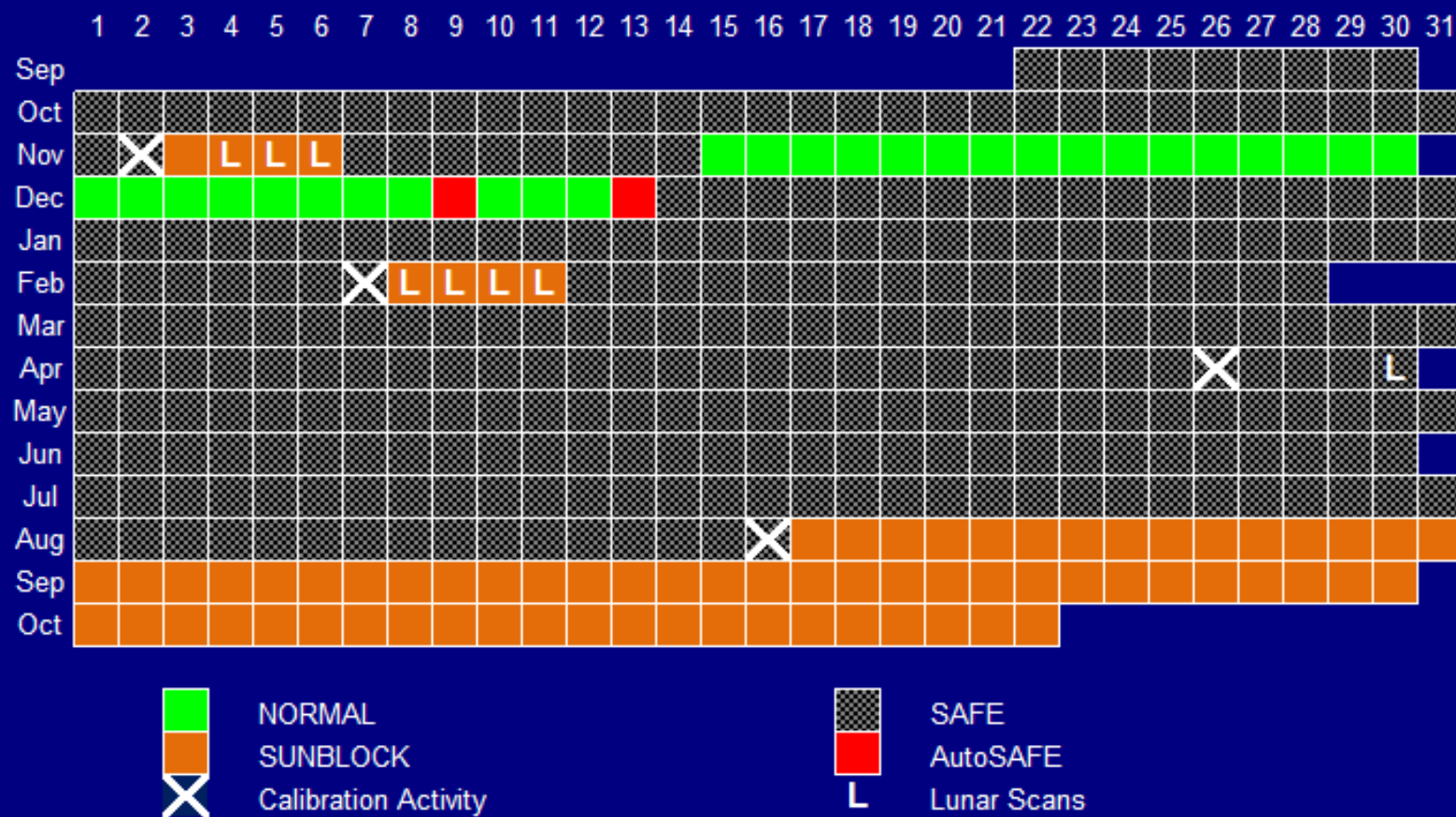
## GERB1 TL Test – Aug 2012



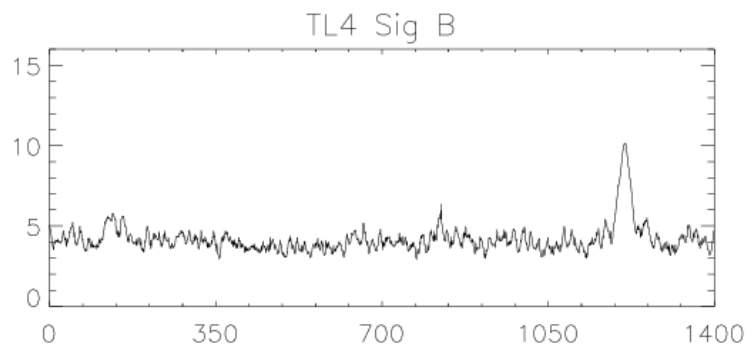
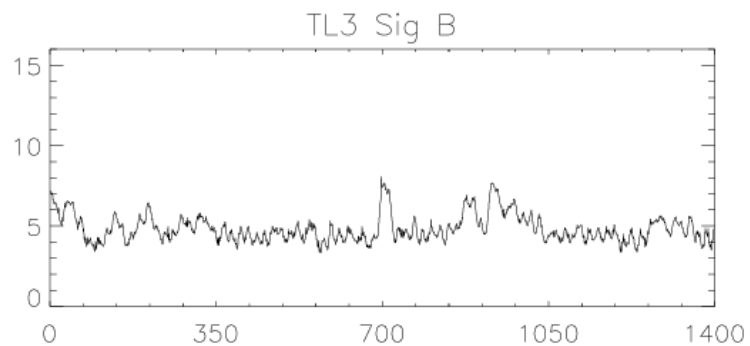
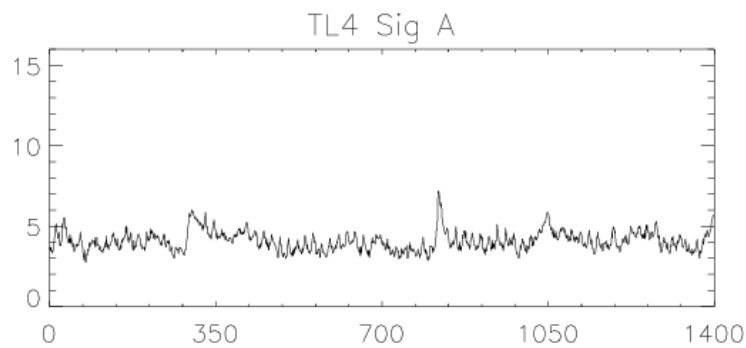
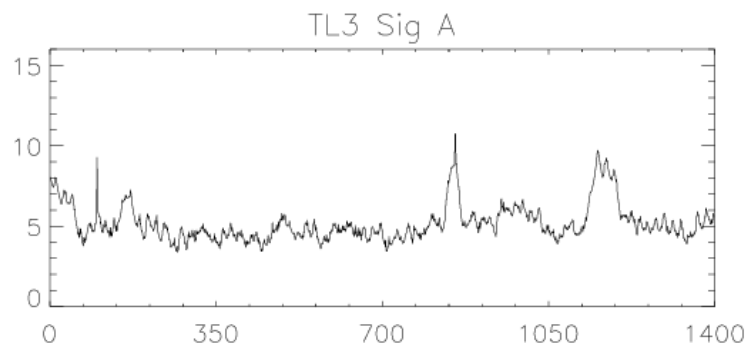
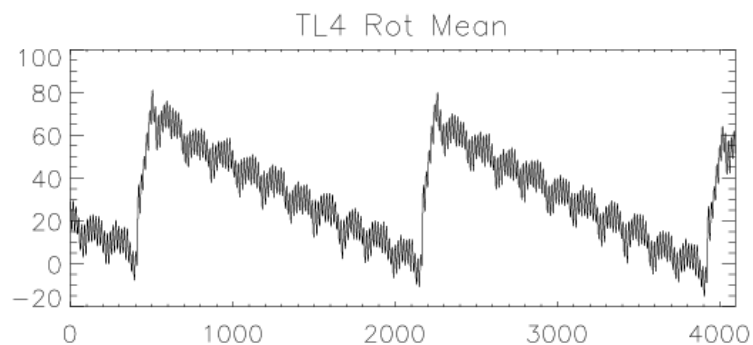
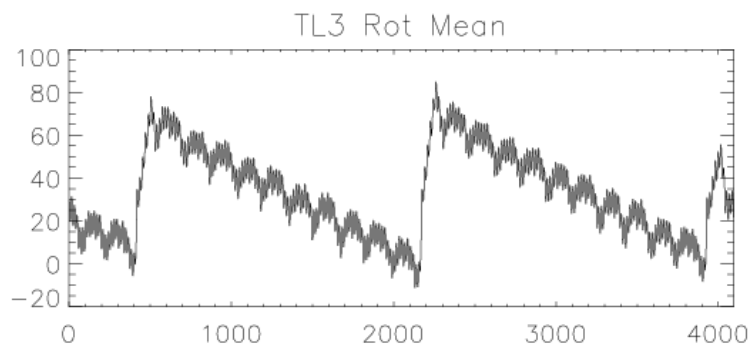
## Review of GERB1 TL Tests



# GERB2 Operations Summary

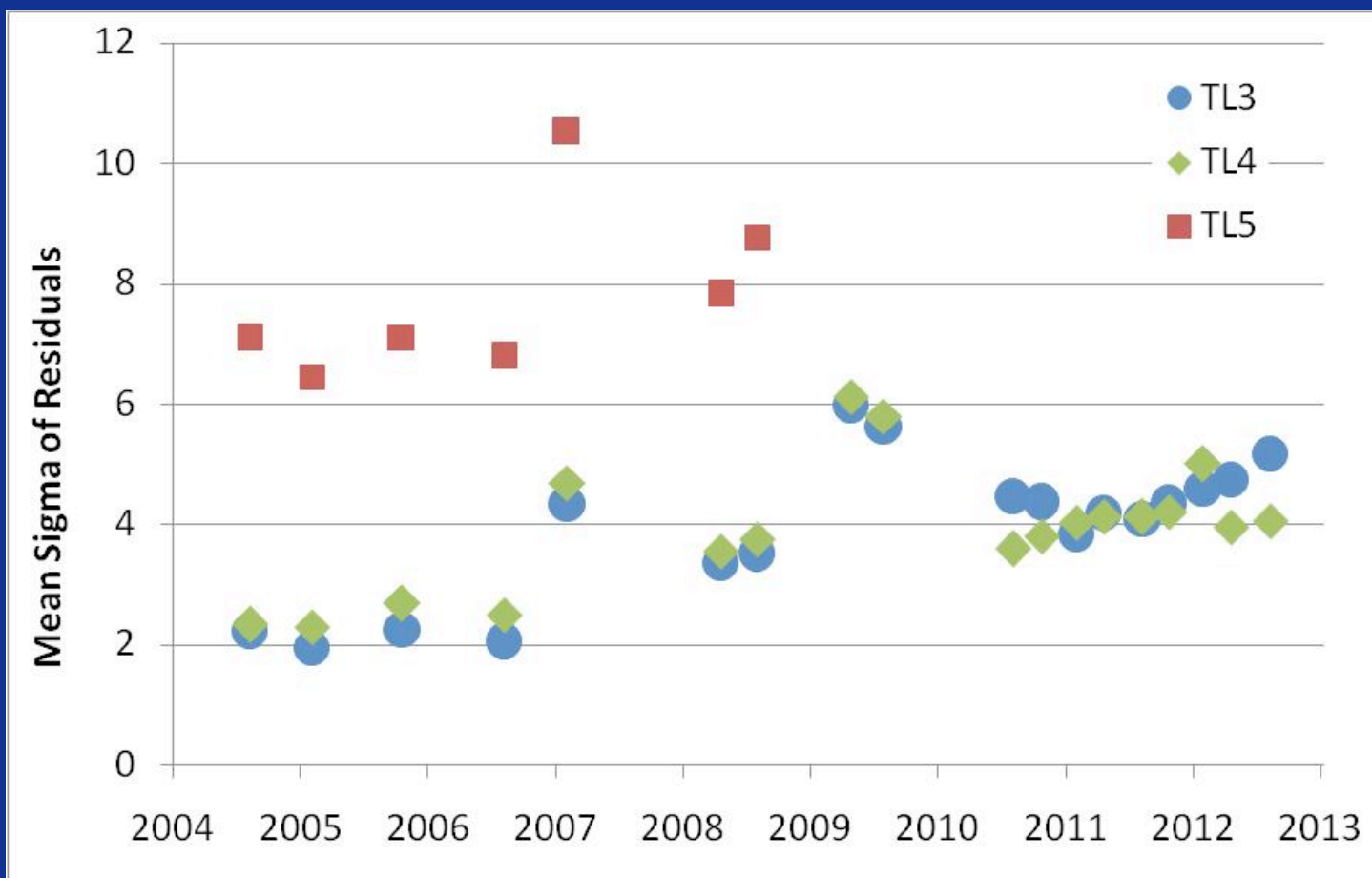


## GERB2 TL Test – Aug 2012

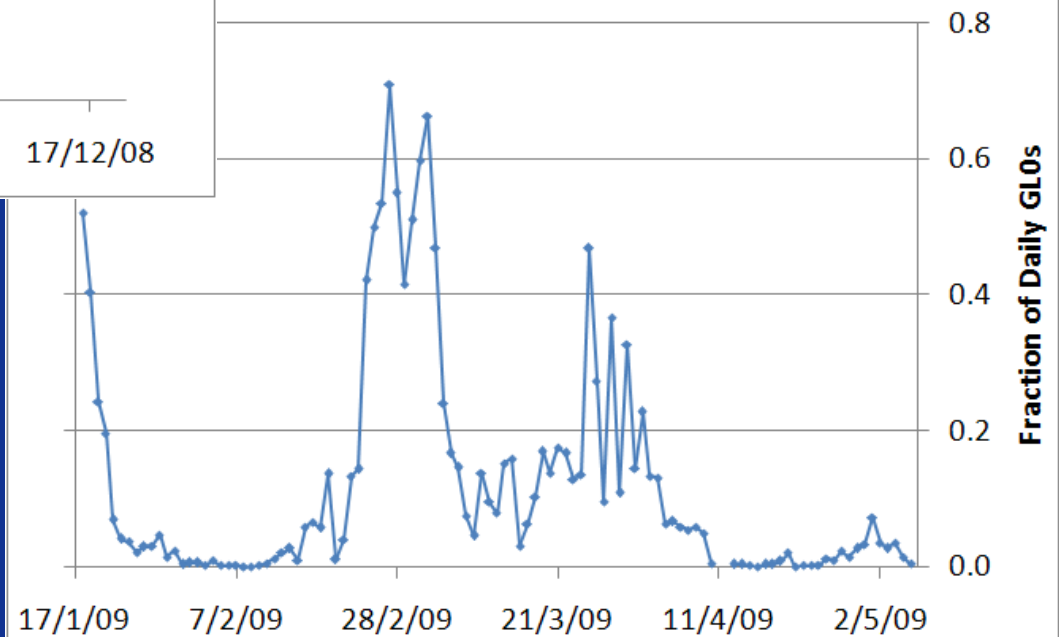
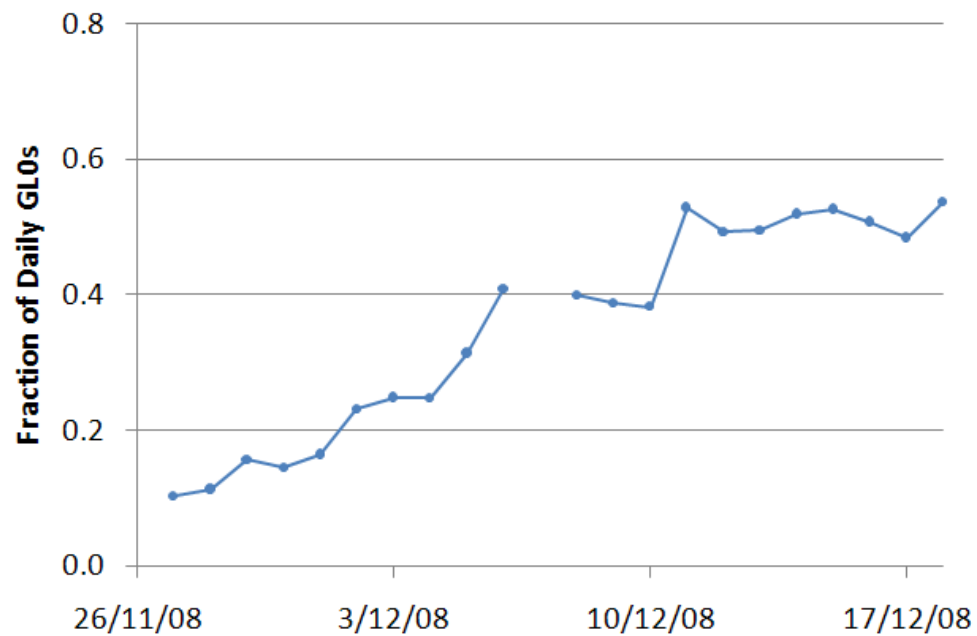




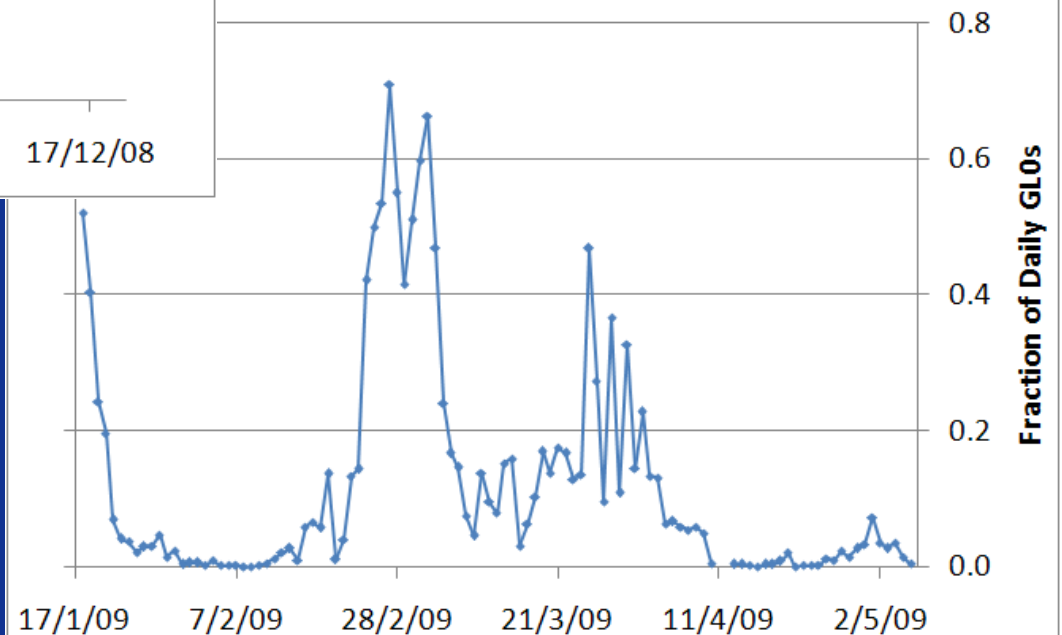
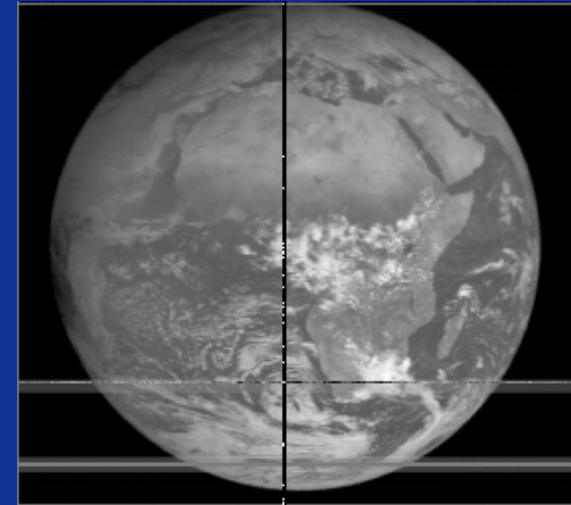
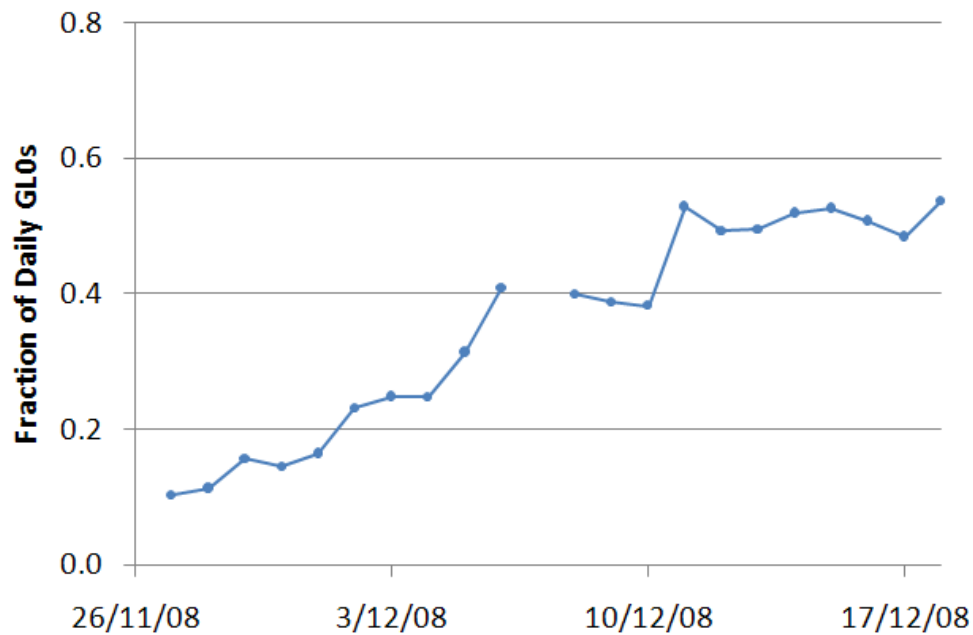
## Review of GERB2 TL Tests



# GERB2 – Daily Fraction of Coarse Flags 2008/9

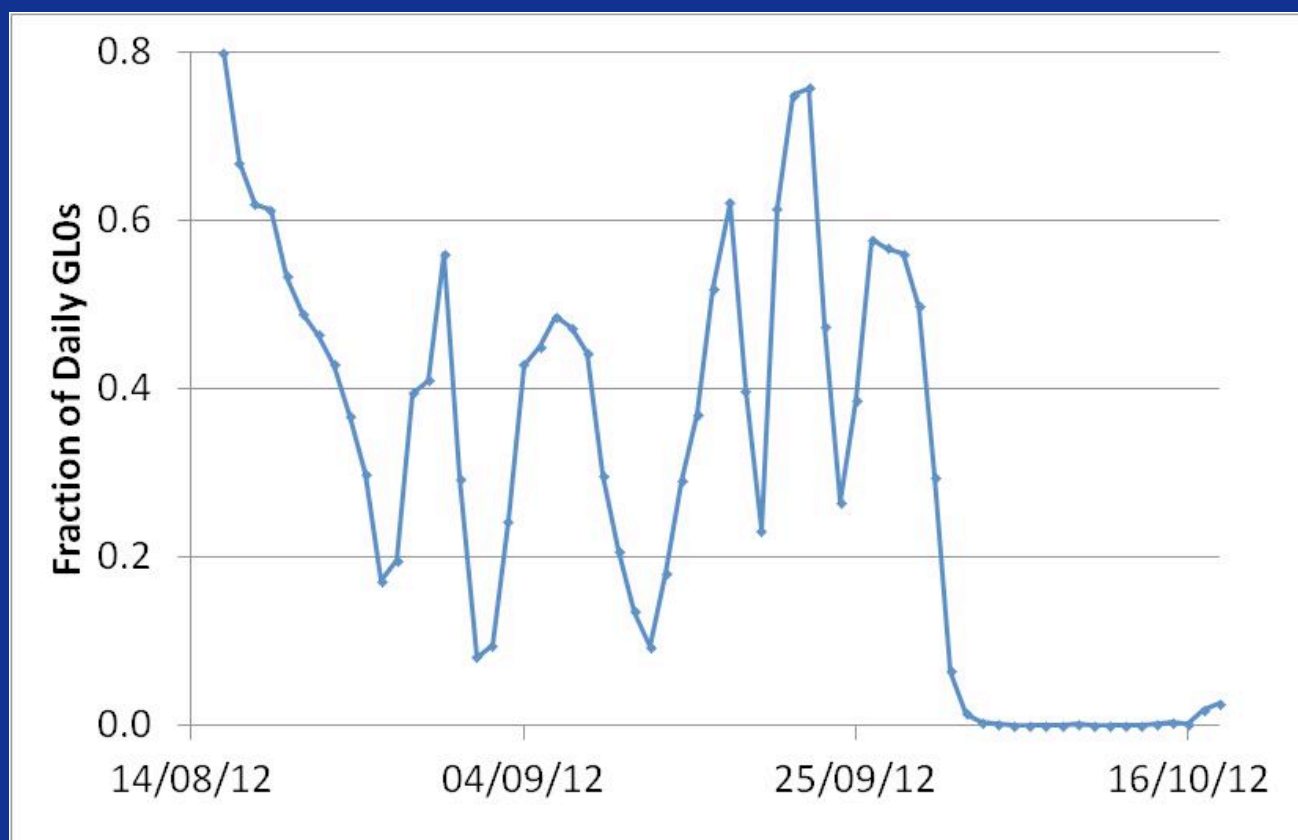


# GERB2 – Daily Fraction of Coarse Flags 2008/9



## Autumn 2012 run on GERB2

Waiting for the situation to evolve but the current smooth running is encouraging.



## GERB3 Launch and Early Operations

MSG-3 LEOP and Commissioning schedule set a period of six weeks between launch and commencement of GERB commissioning.

Original launch date 19<sup>th</sup> June.

GERB functional commissioning set to begin on 30<sup>th</sup> July.

Launched slipped to 5<sup>th</sup> July.

GERB commissioning pushed to the 15<sup>th</sup> August.

Sun Avoidance Season begins 15<sup>th</sup> August!

GERB3 commissioning rescheduled to overlap with end of SEVIRI commissioning and began on 9<sup>th</sup> August.



## GERB3 Commissioning

GERB commissioning is split into two parts, Functional and Calibration. The functional commissioning ensures that all the basic instrument systems are operating correctly, it tests:

- Mode Switching
- Mechanism operation
- Imaging in NORMAL mode
- On-board monitoring
- Heater Control
- Descan Mirror Performance Analysis
- Tests of Autonomous Safety

## GERB3 Commissioning – Despin Mirror Performance

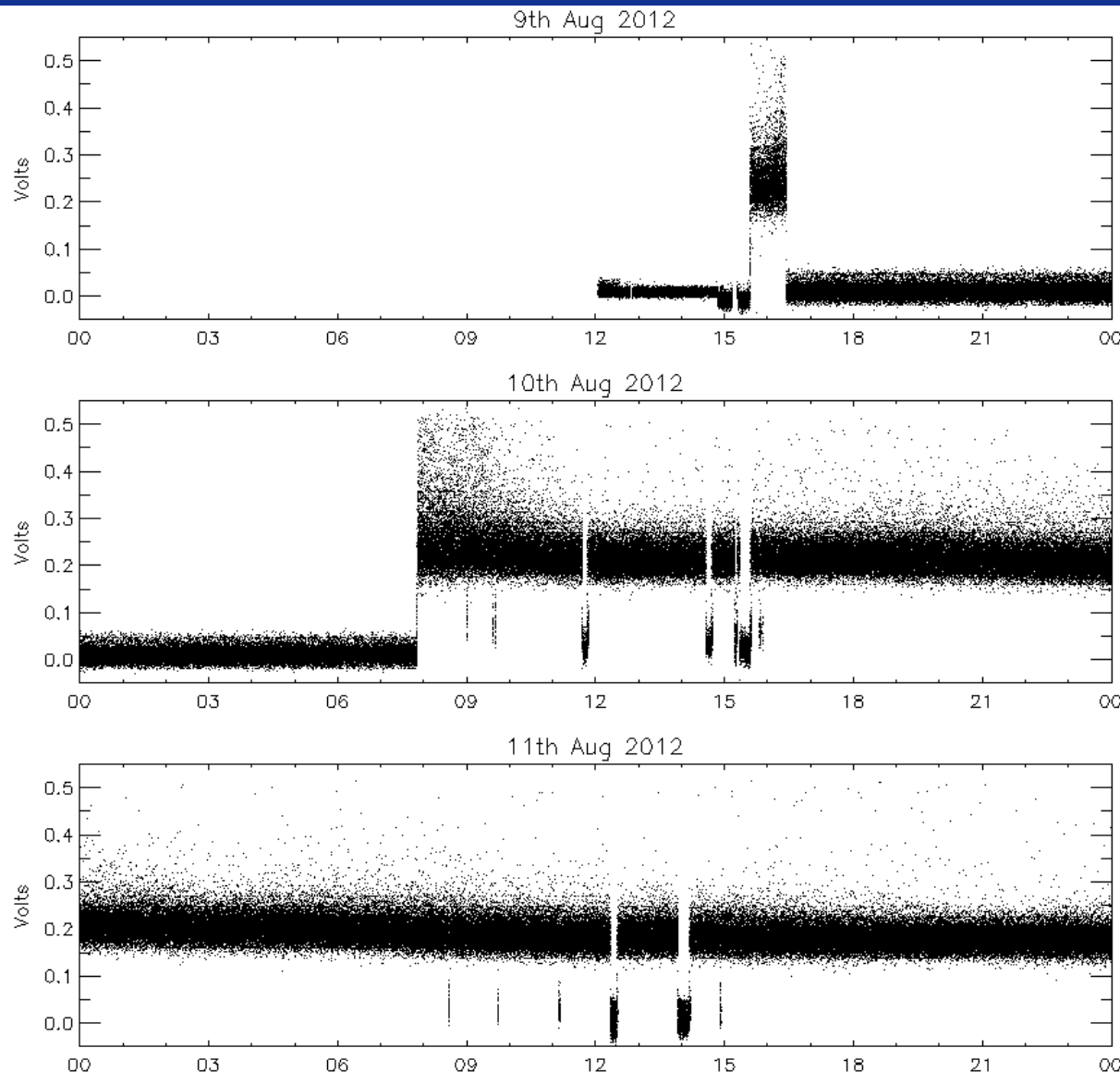
GERB-3 features a new vector mirror control system which automatically regulates torque levels.

During the first few days of commissioning the torque monitor in telemetry shows the torque decreasing.

On the 9<sup>th</sup> the mean torque is 0.24 V (67 mN.m)

The average on the 10<sup>th</sup> is 0.25 V (70 mN.m) with peaks up to 0.55 V

By the 11<sup>th</sup> the torque drops from 0.21 to 0.18 V (59 to 51 mN.m) with significantly fewer outliers.

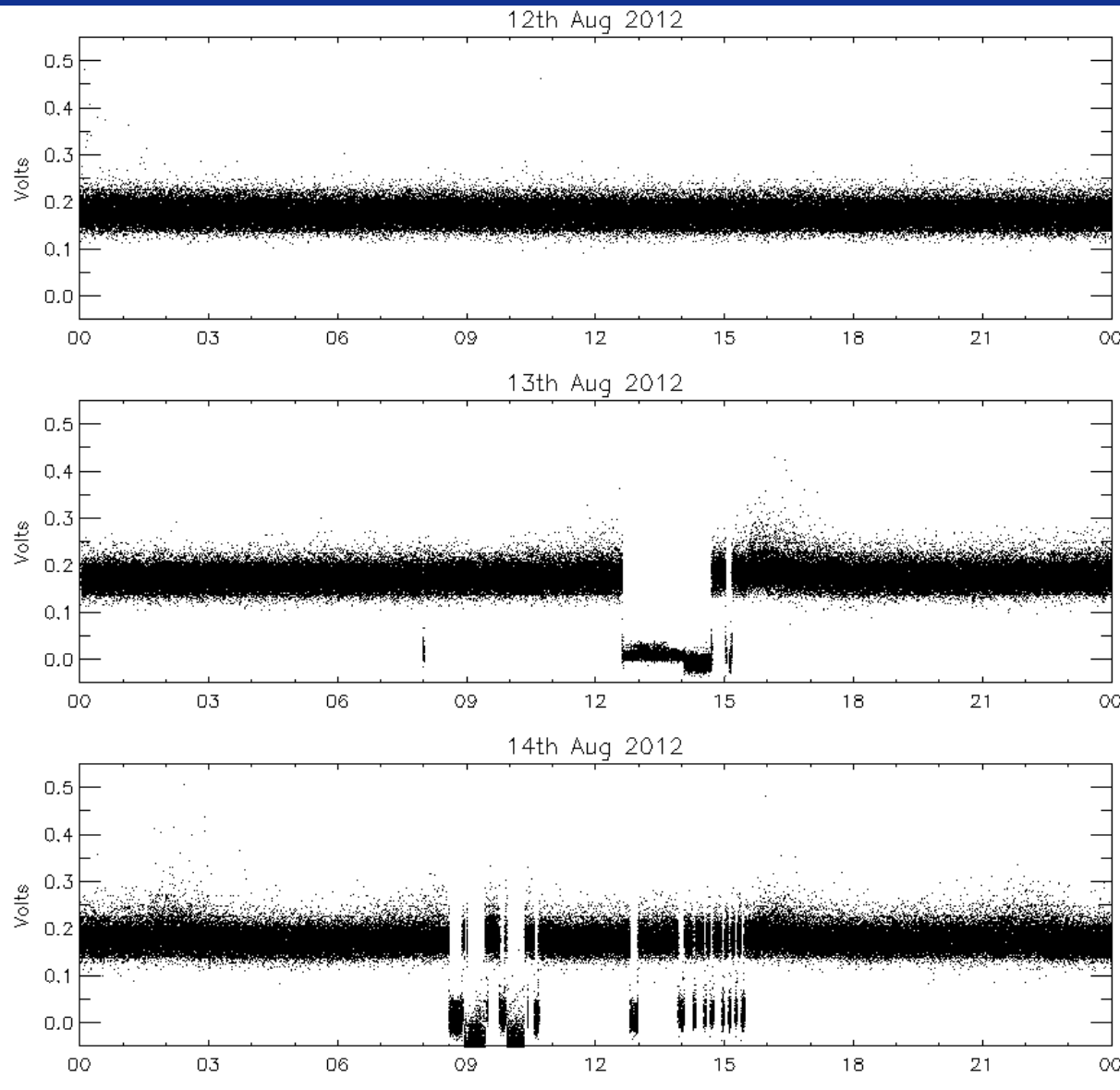


## GERB3 Commissioning – Despin Mirror Performance

Over the next few days the torque level settles with surprisingly few outliers for this early in the lifetime of the bearing compared to previous instruments.

Occasional spikes in the instrument current were seen over this time which didn't correlate to with other telemetry.

If these spikes (~66 mA) are due to increased torque demand they represent a third of the maximum torque available.



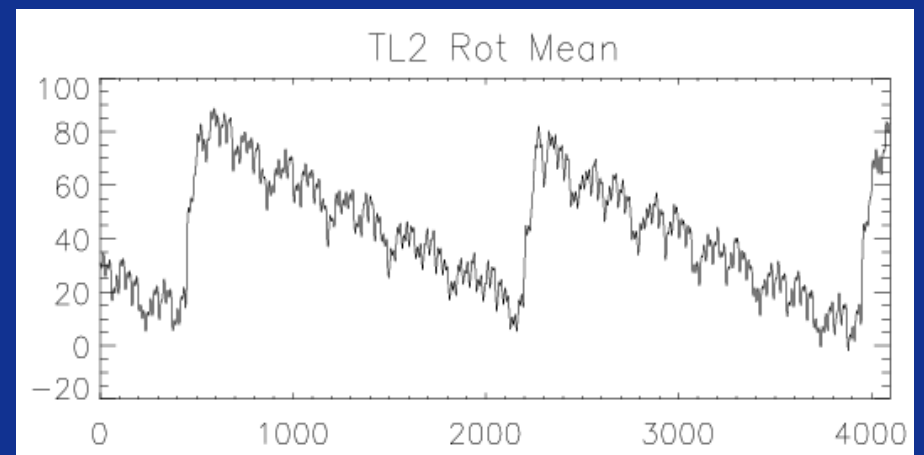
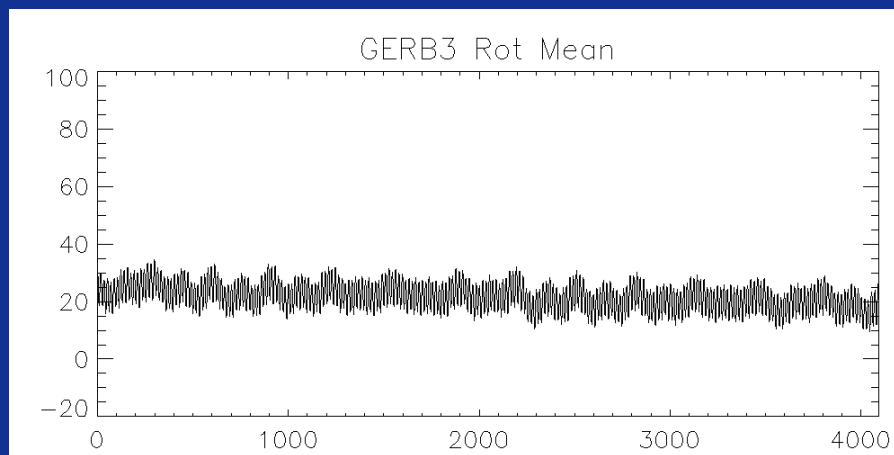
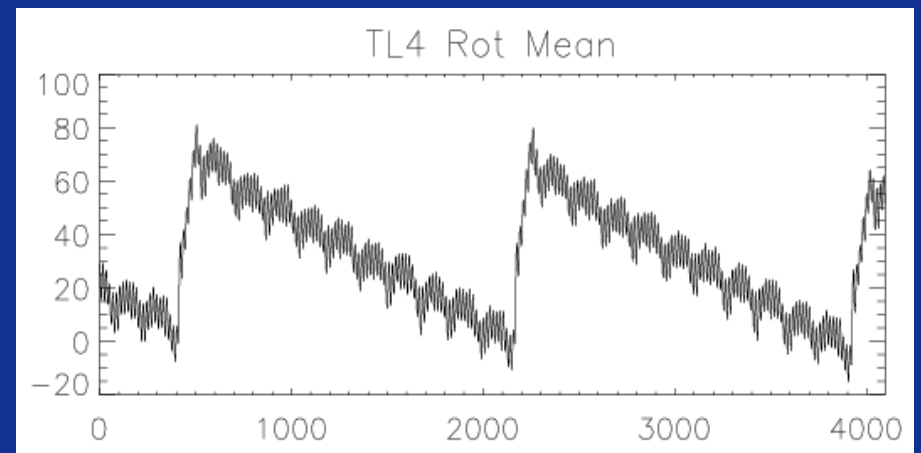


## GERB3 Commissioning – Despin Mirror Performance

Despite not having selectable torque levels we can run analysis of the SUNBLOCK data to compare GERBs 1-3.

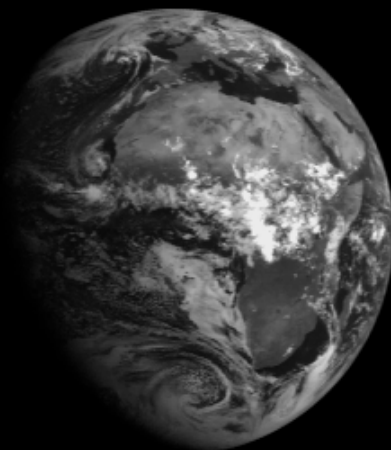
GERB3 show tighter pointing control over the entire rotation.

Bearing noise is similar to that of GERB-2 at in its initial operation in orbit but is expected to improve as the bearing runs in and torque levels lower.

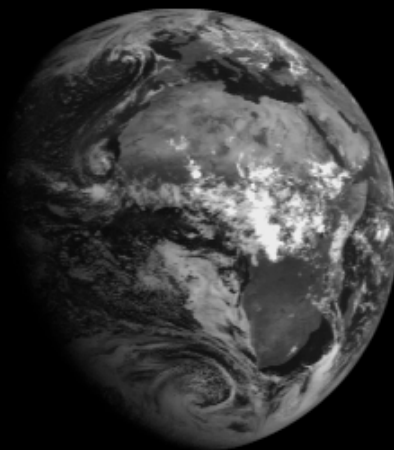


## GERB3 Commissioning – First Images

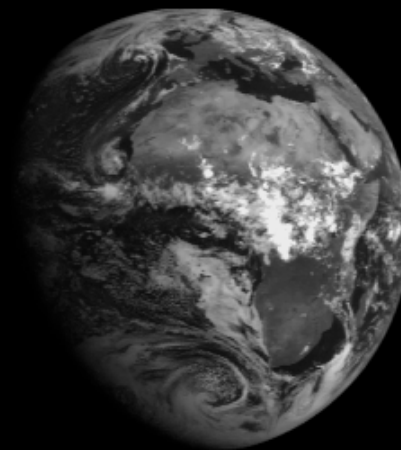
G3\_L15N\_20120810\_090010\_V001 plotted Fri Aug 10 09:45:11 2012



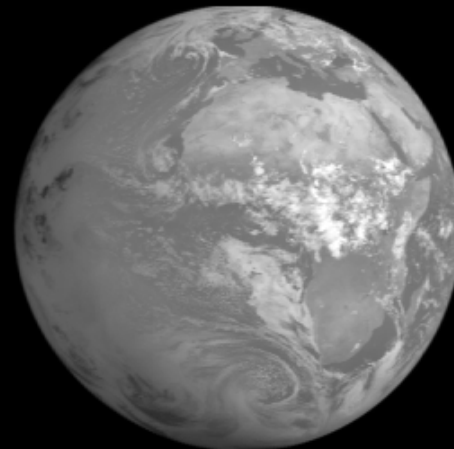
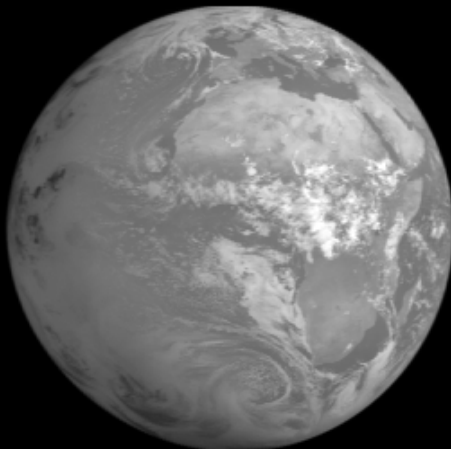
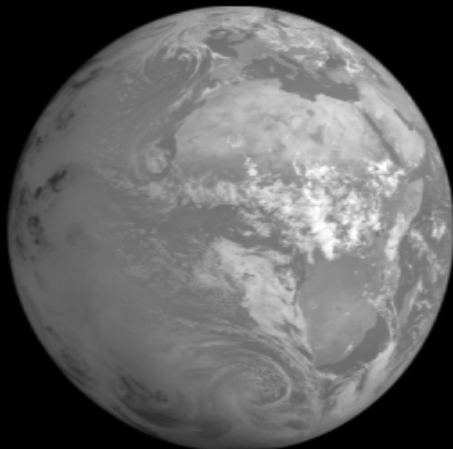
Scan 1



Scan 2



Scan 3



## GERB3 Commissioning – Autonomous Safety Responses

The GERB instrument uses two onboard safety monitoring procedures:

**AutoSAFE** Switches down to SAFE mode in the event of a temperature, current or voltage violation or stray light signal detected in the deep space columns.

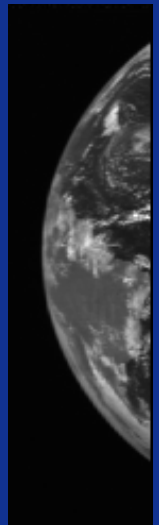
**AutoSUNBLOCK** A faster response, switching down to SUNBLOCK in the event of a mirror OOL.

Pixel thresholds were set from deep space observations with a small offset added.

The response was tested by extended the deep space columns checked (nominally 3 at each extreme) to include Earth Pixels and the safety routine executed correctly.

The AutoSUNBLOCK mirror limits are set in software and for the test were reduced to 7 mV below the upper 'in-lock' limit of 20 mV.

It took 67 rotations before the mirror tripped this limit.



## GERB3 Calibration Commissioning

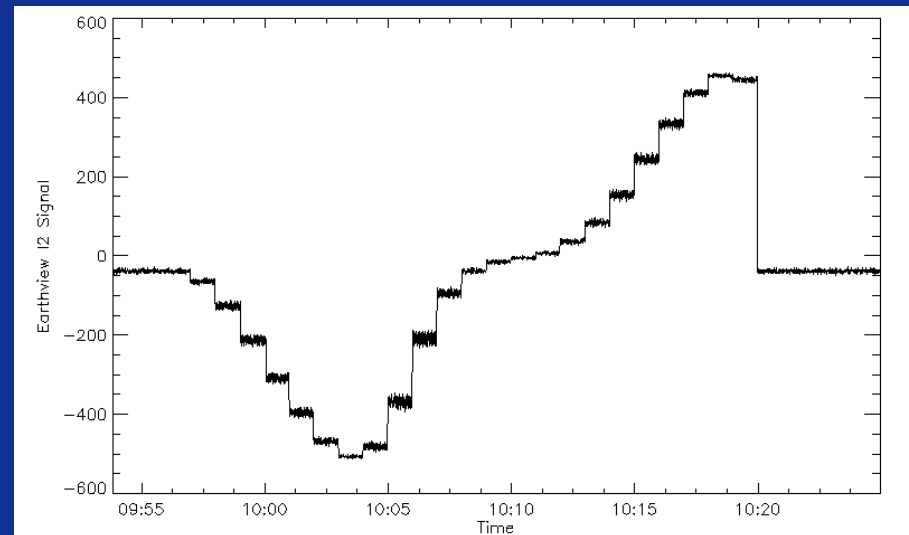
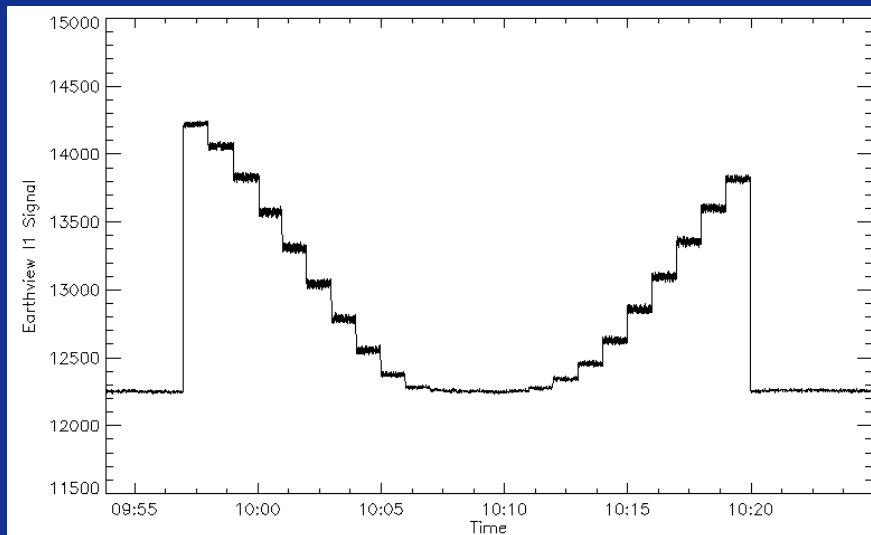
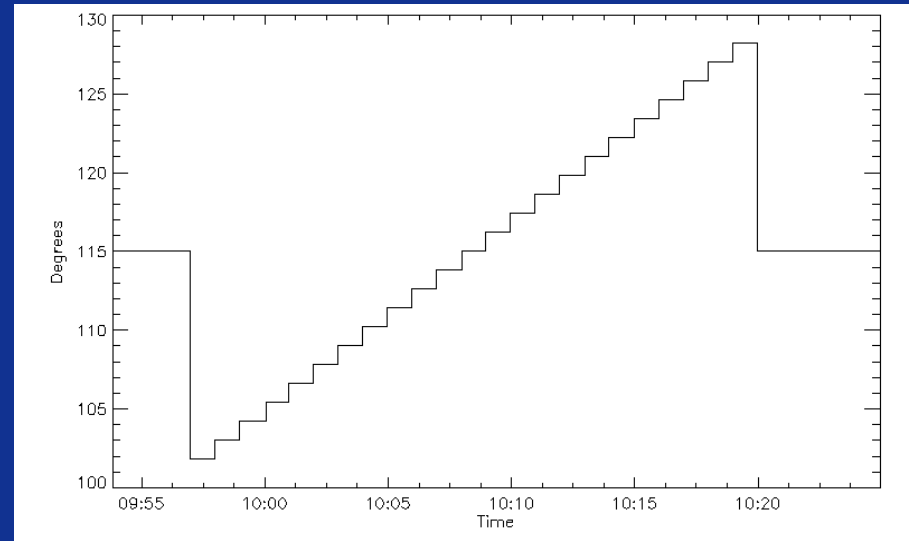
Calibration commissioning sets a baseline for the performance of the instrument and consists of seven tests:

- Detector Alpha Values Checks
- Deep Space Observations
- Point Spread Function Tests
- Scan Direction Dependency Test
- Mirror Side Offset Tests
- Lunar Observations
- Integrating Sphere Properties

# GERB3 Commissioning – Detector Alpha Values

The Earthview port and the acquisition time for the Earth signal are systematically detuned to test the response of the detector.

$$\text{Signal} = I_1 + \alpha I_2$$

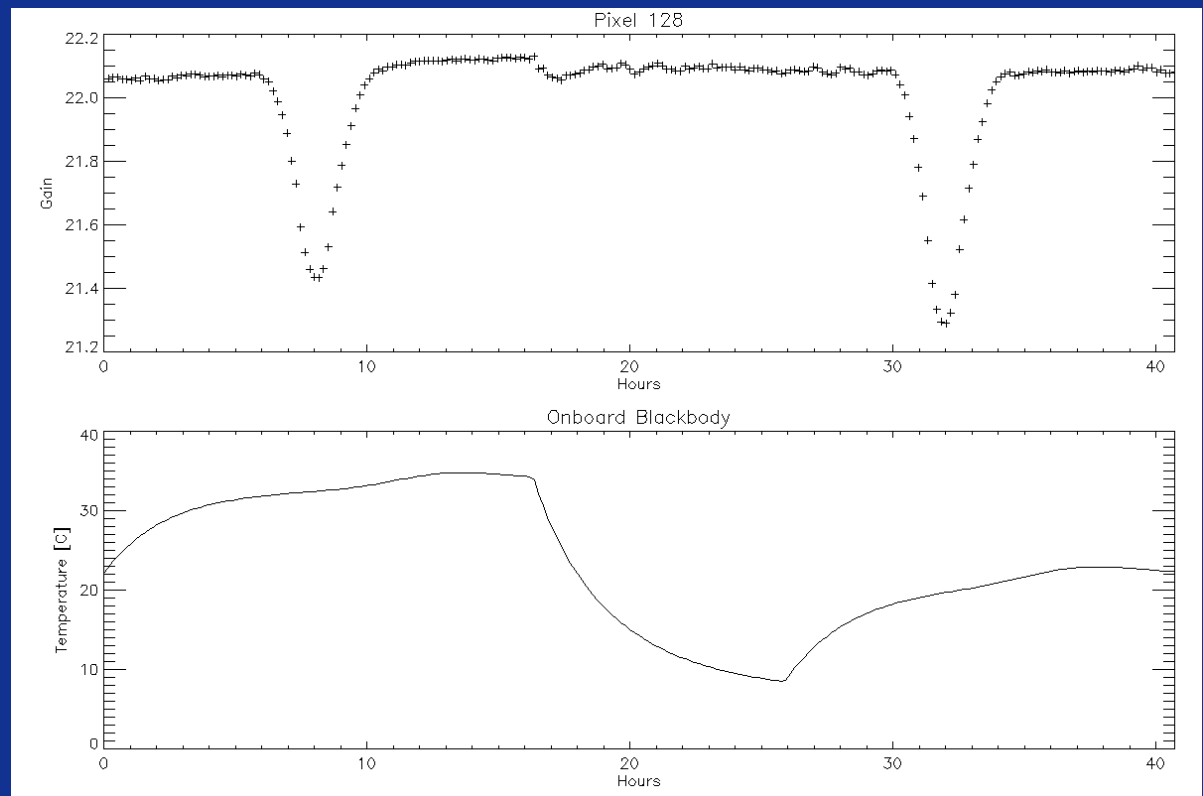


## GERB3 Commissioning – Deep Space

The Deep Space scans provide a test of the GERB total gains from observing two known sources, the zero signal from space and the ground calibrated onboard blackbody.

During the observations the blackbody is driven through its full temperature range to test the stability of the gains.

The data plotted shows a typical pixel response over the 40 hours of the test. The large changes in gain around local midnight are due to stray light similar to that seen in previous instruments



# GERB3 Commissioning – Point Spread Function

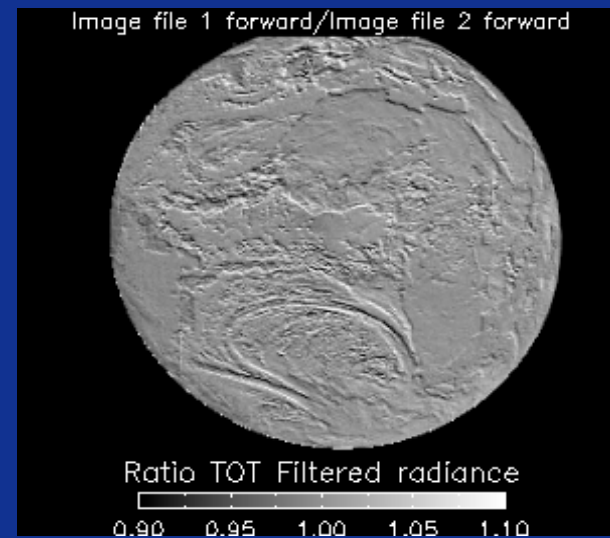
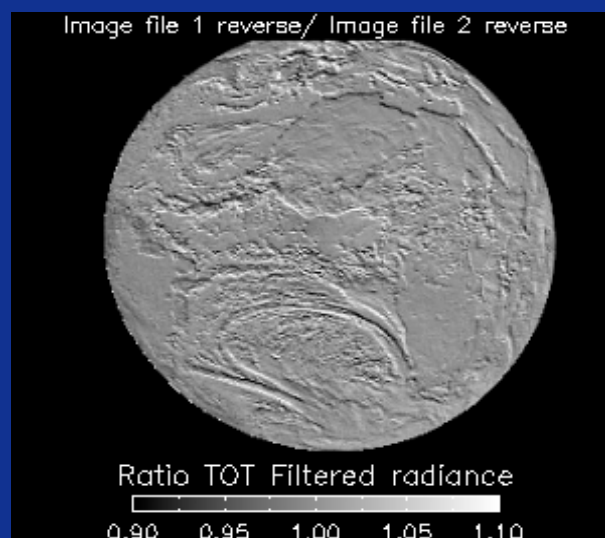
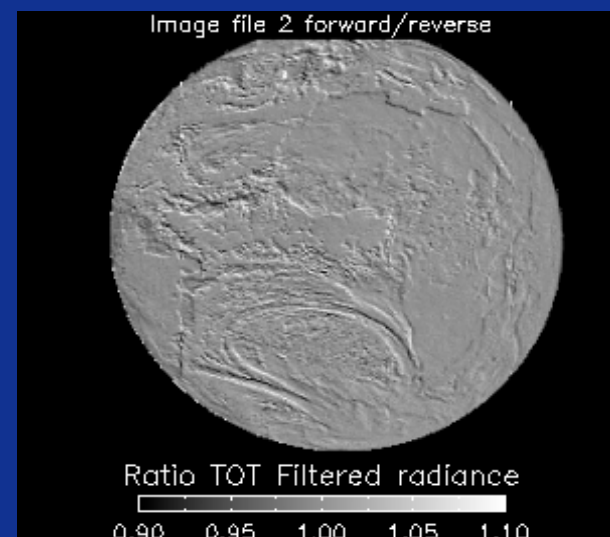
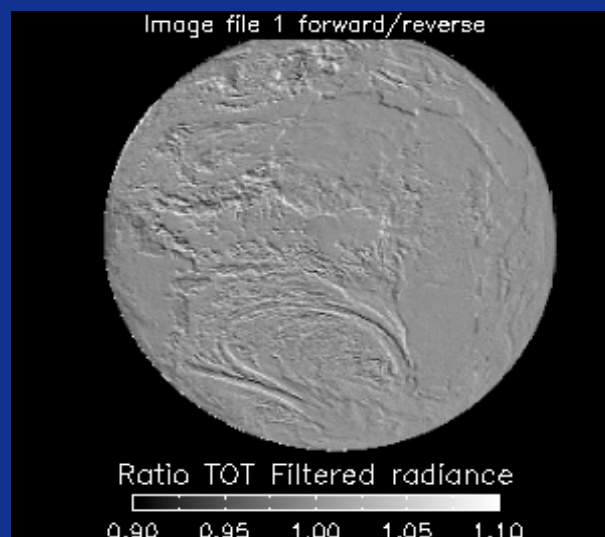
Scan type	Scan step size	Number scanlines	Area scanned	Date/time scanned	Purpose
Default	0.421'	1400	Full disk	09:00-11:10 11/08/12 12:00-14:00 11/08/12 14:00-15:00 11/08/12 13:00-13:40 14/08/12	PSF and pointing characterisation
High res. Earth limb	0.084'	600	Eastern Earth limb	14:00-16:00 14/08/12	Optical and pointing characterisation
Mirror side offset	0.527'	1128	Full disk	09:30-13:30 15/08/12	Pointing characterisation
African coastlines	0.117'	1800	20°W – 30°E	11:00-13:00 16/08/12	PSF – north-south coastlines

## GERB3 Commissioning – Scan Direction

The standard operation for data acquisition scan E-W in the TOT channel and W-E in the SW.

To confirm that there are no biases introduced by scanning channels in opposite directions a scan table using the total channel in both directions was examined.

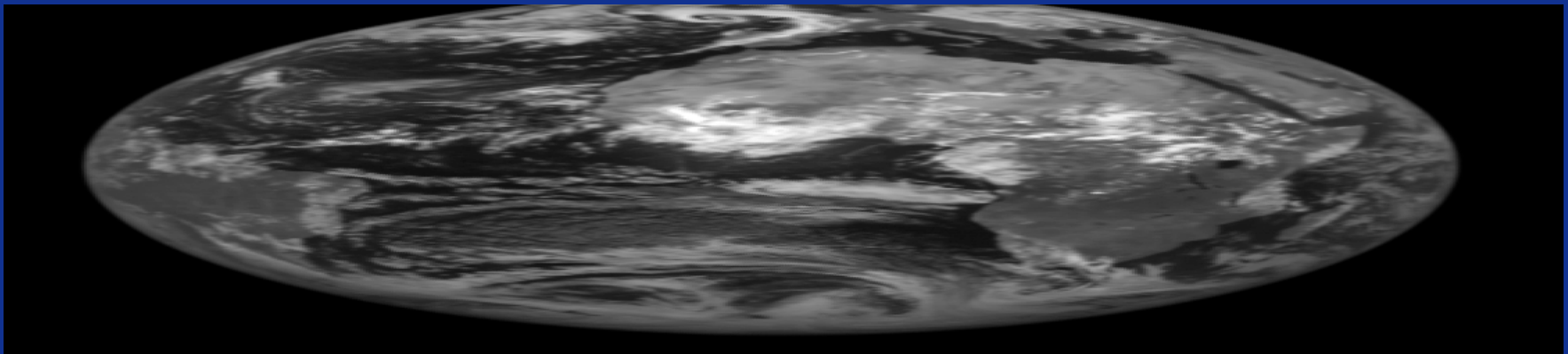
Results showed no bias was introduced.





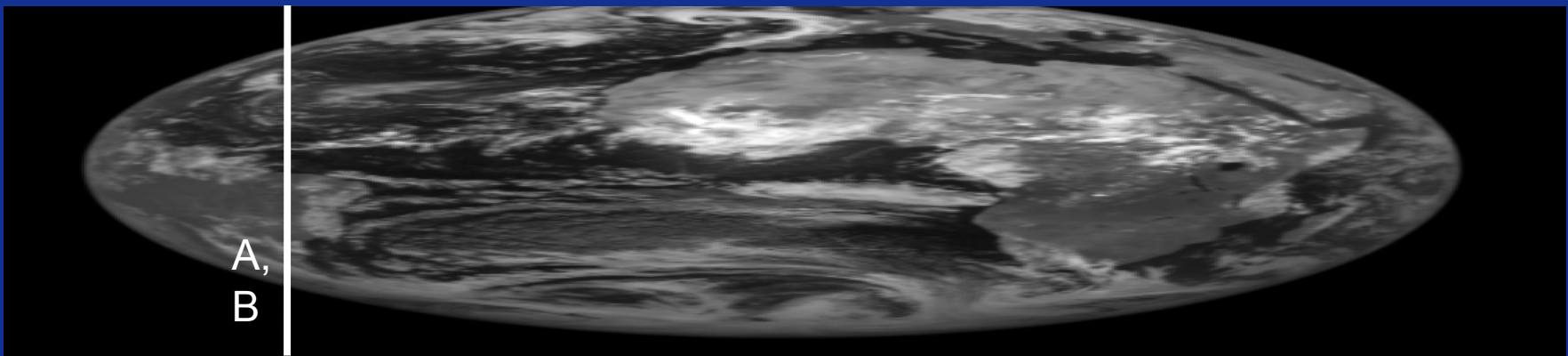
## GERB3 Commissioning – Mirror Offsets

The Mirror Offset tests employs a double normal resolution scan with both mirror side offsets set to non zero values in the instrument software. Side 1 is set to the best estimate of the horizontal non parallelism of the mirror faces. Side 0 is set to the step size of the scans.



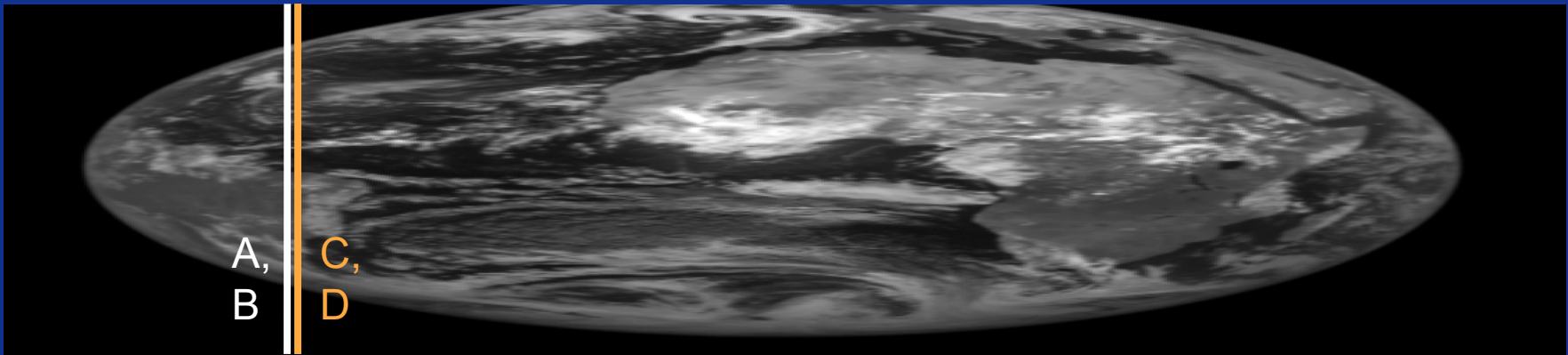
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## GERB3 Commissioning – Mirror Offsets

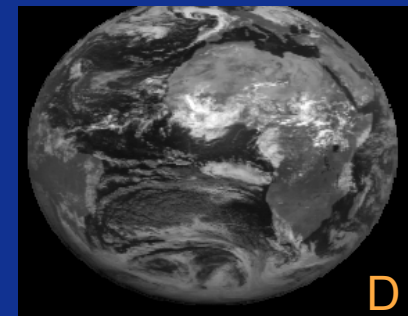
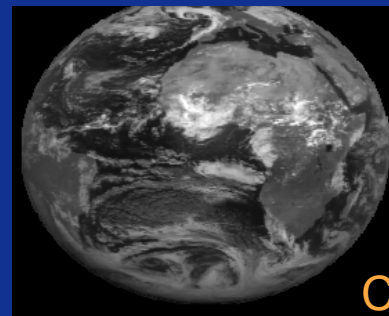
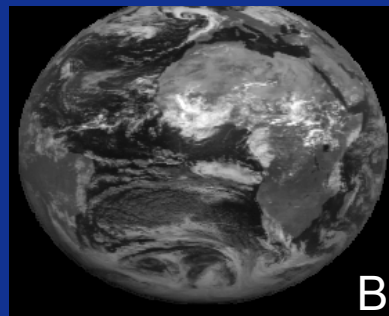
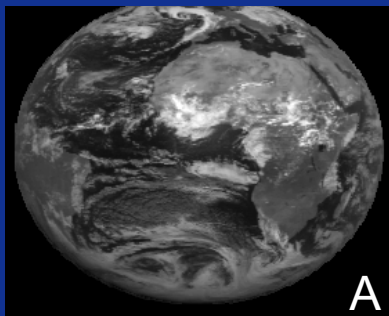
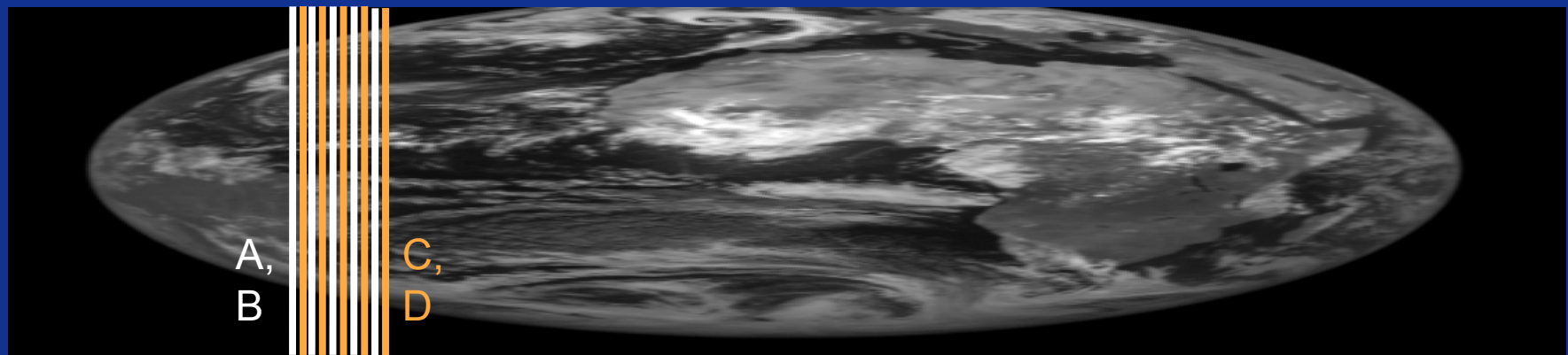
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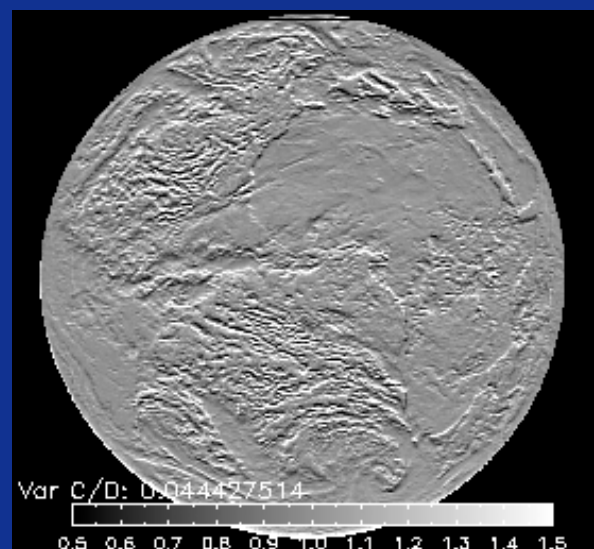
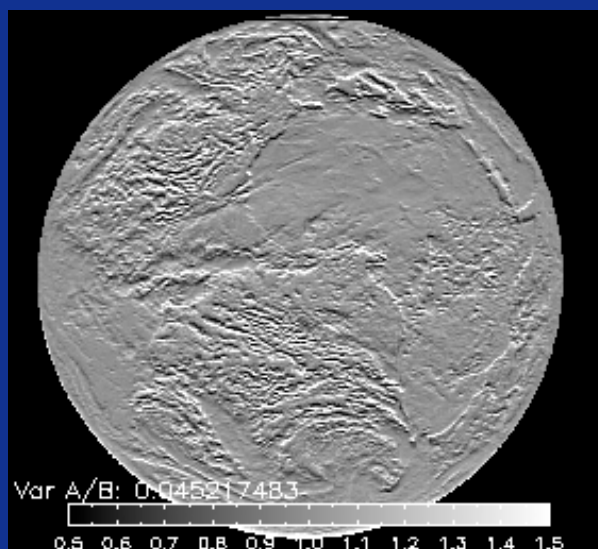
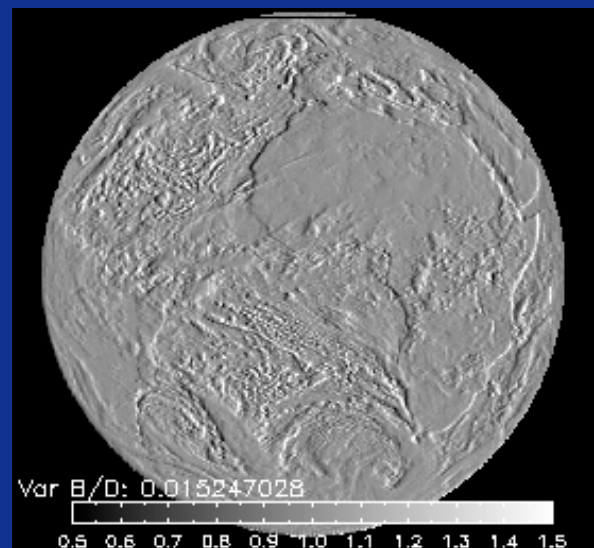
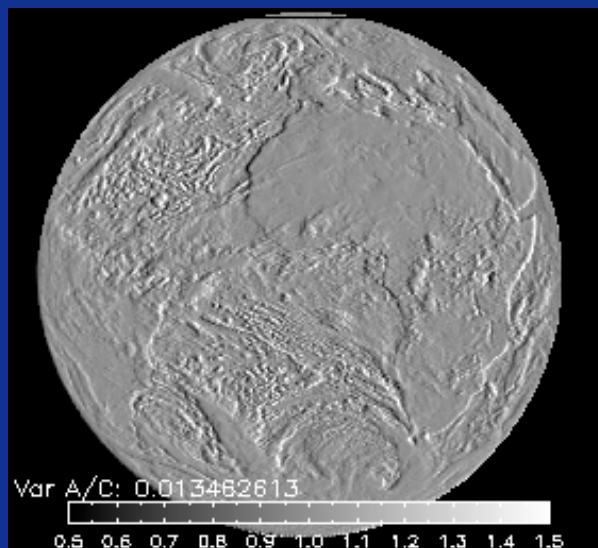
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Side 1 is set to the best estimate of the horizontal non parallelism of the mirror faces.  
Side 0 is set to the step size of the scans.

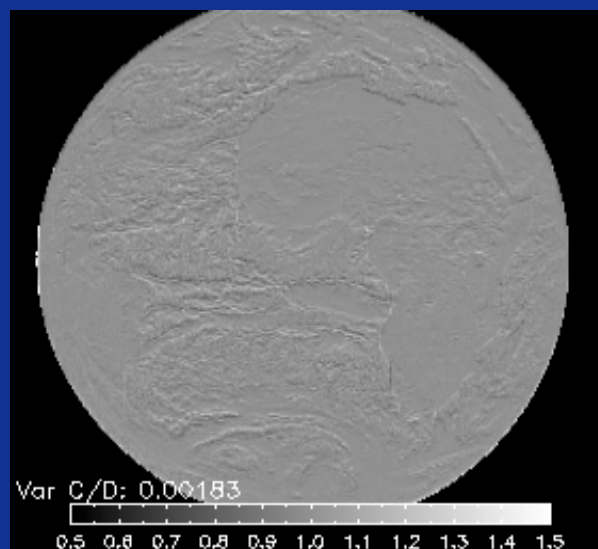
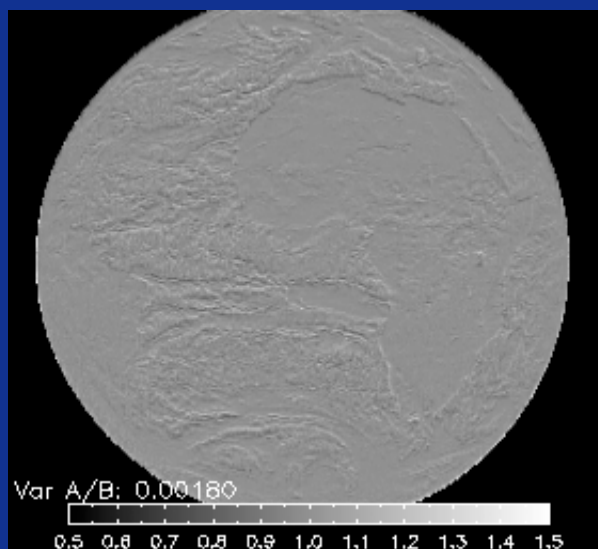
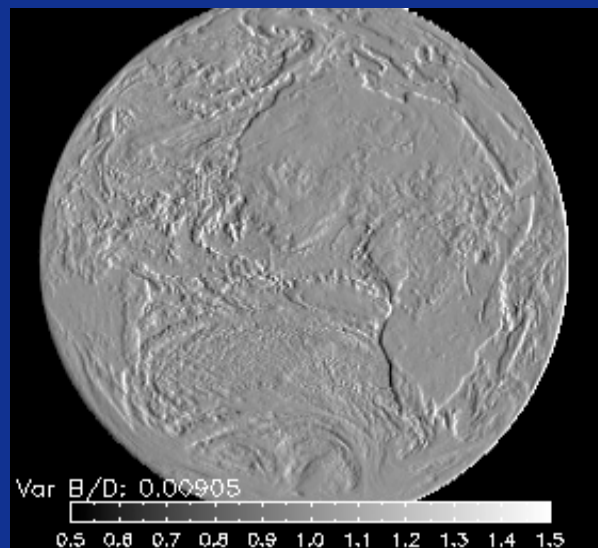
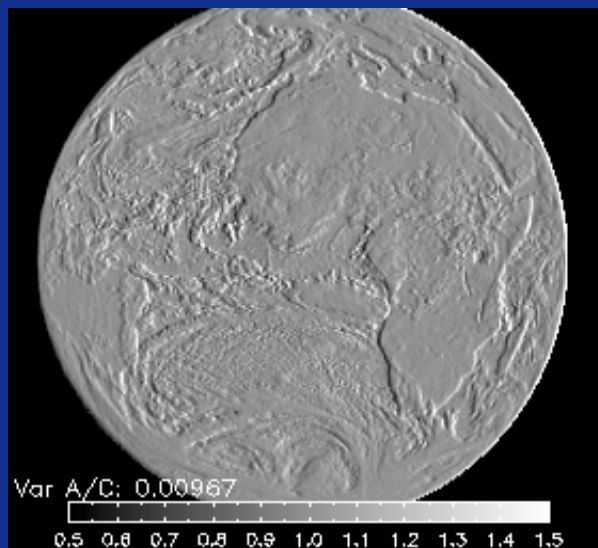


## GERB3 Commissioning – GERB1 Results

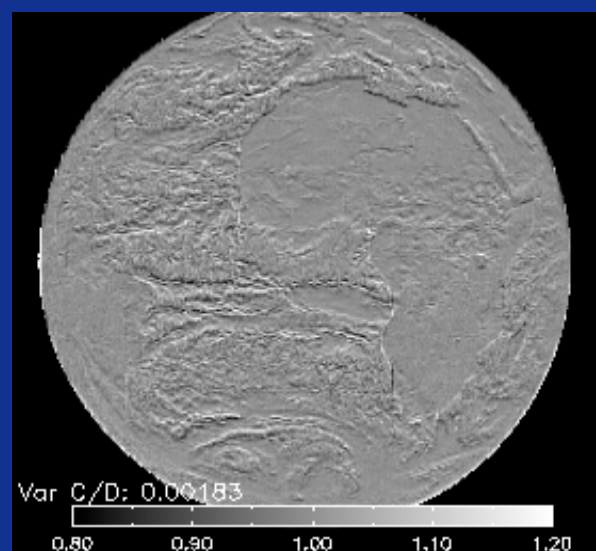
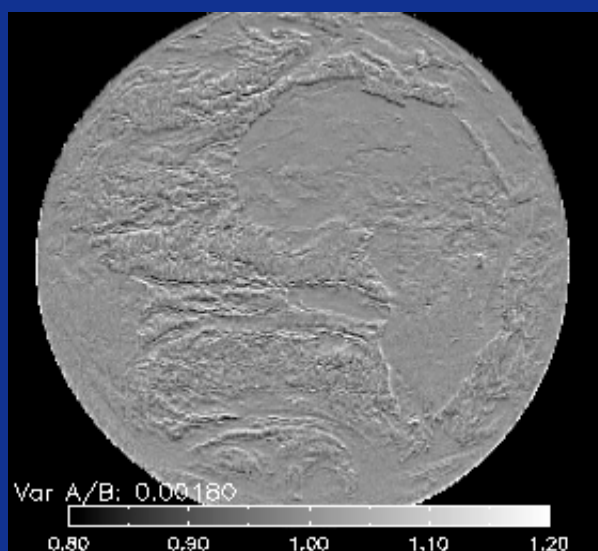
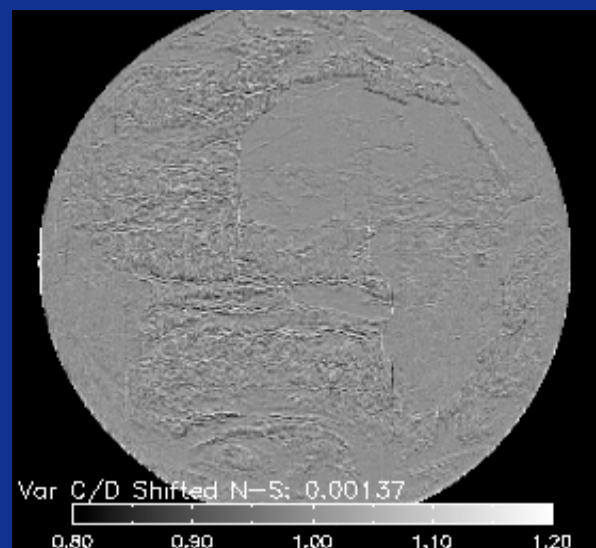
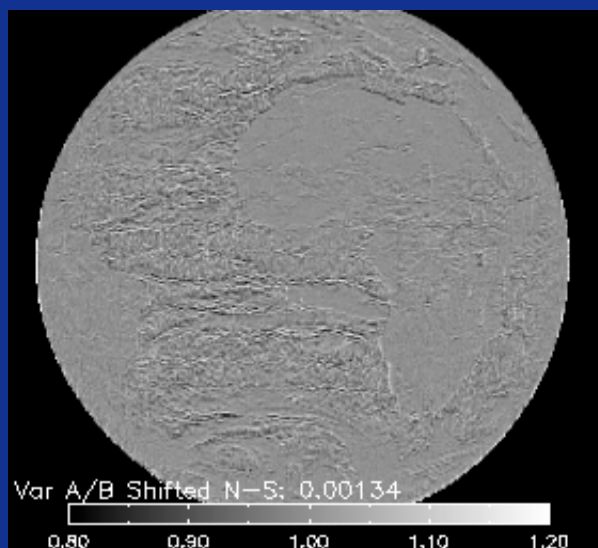




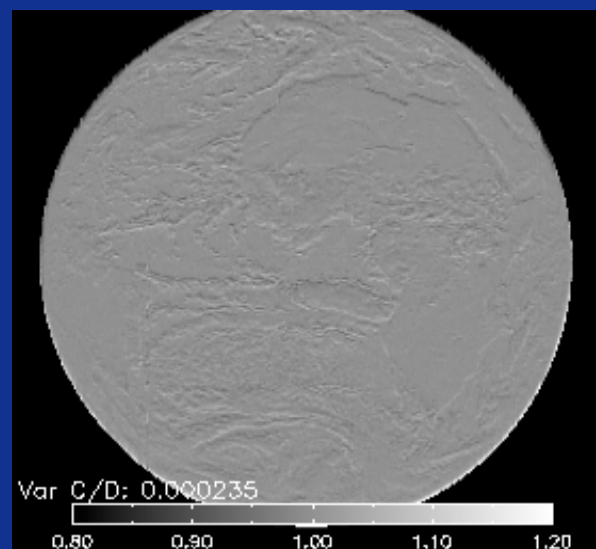
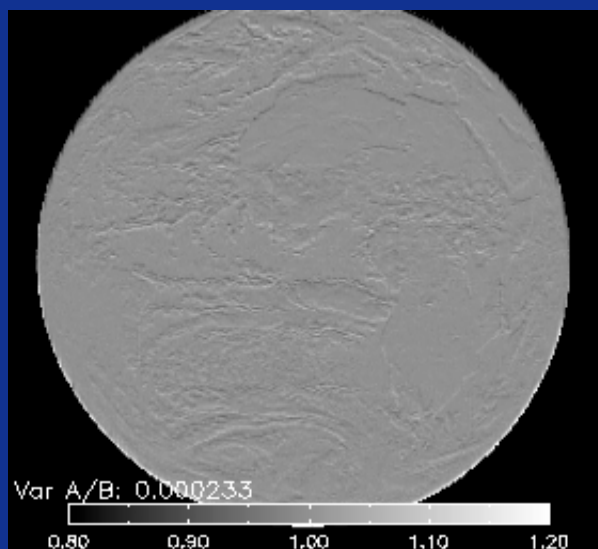
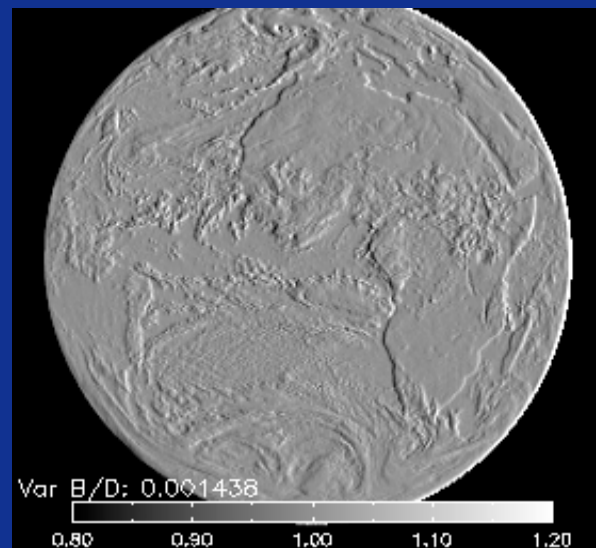
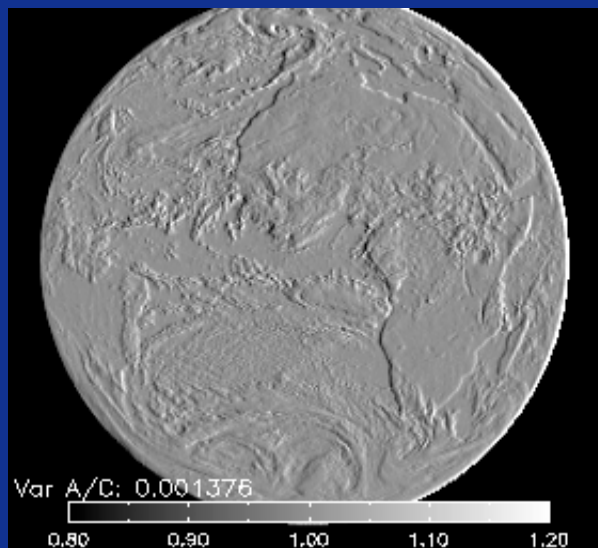
## GERB3 Commissioning – GERB3 Results



## GERB3 Commissioning – GERB3 Results

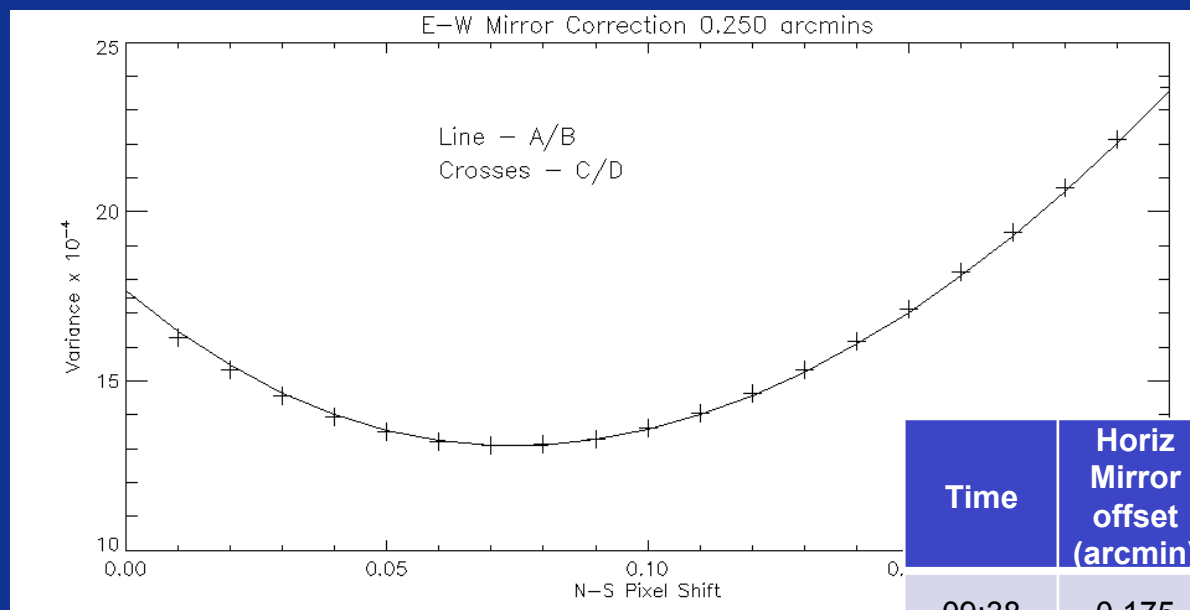


## GERB3 Commissioning – GERB3 Results TOT channel





# GERB3 Commissioning – GERB3 Results



The final mirror offsets were found to be:

- N-S 0.075 pixels / 0.158 arcmins
- E-W 0.119 pixels / 0.250 arcmins

Time	Horiz Mirror offset (arcmin)	SW A/B Min Var	SW C/D Min Var	TOT A/B Min Var	TOT C/D Min Var
09:38	0.175	14.8	14.5	1.58	1.47
10:04	0.200	14.2	14.7	1.56	1.48
10:30	0.225	13.2	13.4	1.57	1.43
10:55	0.250	13.2	13.2	1.52	1.56
11:21	0.275	13.5	13.6	1.60	1.56
11:46	0.300	13.4	13.7	1.67	1.68
12:12	0.325	13.6	13.3	1.70	1.73

## Summary & Future Operations

- GERB1 Mirror bearing running well, despite occasional bursts of noise.  
Plan to maximise GERB1 data acquisition until MSG2 takes over RSS.
- GERB2 Mirror bearing fluctuates between high levels of sticking events and nominal performance.  
Any future data gathering would benefit from a long run in time if the elongated runs from 2008/09 and 2012 typical.
- GERB3 Functional commissioning complete and successful.  
Calibration commissioning complete excepting:  
First Calmon observation (4<sup>th</sup> November)  
First Lunar observations (3<sup>rd</sup>-6<sup>th</sup> December)  
TRB on GERB3 commissioning completed 18<sup>th</sup> October.  
Return to data acquisition 29<sup>th</sup> October.